

Call for cooperation: biometric template ageing

Adam Czajka

V-ce Head, Biometric Laboratories, NASK
Assistant Professor, Warsaw Univ. of Technology
Warsaw, Poland
www.BiometricLabs.pl, adam.czajka@nask.pl

**IBPC 2010, March 4, 2010
NIST Gaithersburg, MD**



■ Source of age-related changes

- Natural processes of our body or behavior changes
 - Not adequately studied for most of the biometric modalities
 - Indirect due to diseases, injuries and surgeries

■ Ageing sources for selected modalities [Lantinis 2010]

- **Iris:** cataract (cloudiness of the eye lens), increase of blood pressure within the eyeball (often associated with glaucoma)
- **Fingerprints:** low skin elasticity = problems with fingerprint capture; wear and tear
- **Face:** bone movement and growth (childhood, puberty), skin deformations (old age) due to lowering the skin elasticity and wrinkles
- **Voice:** loss of lungs elasticity, vocal muscle atrophy, anatomical changes in larynx, epithelium thickening

■ Typical solutions

- Template frequent (and forced) update
- Simulation of the ageing effects
 - Based on „age progression” methods
 - Investigated for face biometrics [Giraldi 2009, Ramanathan 2006] (used when searching for missing persons), voice biometrics [Gurbuz 2000] and fingerprints [Ryu 2007]
 - No adequate attention in the literature for other modalities
 - Usage of age invariant biometric features

■ Lack of ample data bases

- Biometrics: relatively young technology
- Technological problems: equipment and measurement protocols must be kept for long time periods
- Availability of volunteers during the database collection
- Sociological resistance (e.g. creation and usage of templates for children)

■ MORPH

(Craniofacial Longitudinal Morphological Face Database)

[Ricanek 2006, www.faceaginggroup.com]

- Biometric type: **face**
- Two sets
 - Album 1: scanned photographs; population: 515 subjects; time intervals from a few months up to 29 years;
 - Album 2: digital images; population: 4000 subjects; time intervals: several years
 - Metadata available: race, date of birth, date of acquisition, gender, eye coordinates
- Seems to be the largest publicly available ageing database (yet for only one modality)
- Dedicated for use with standard face recognition algorithms
- Research (ready) and commercial (planned) use

■ FG-NET [www.fgnet.rsunit.com]

- Biometric type: **face**
- Population: 82, 6-18 images per subject
- Auxiliary data available
 - Preprocessing data:
 - Face localization (68 landmarks)
 - Existance of occluions (beard, moustache, hat, glasses)
 - Face vertical and horizontal pose
 - Demographic data: age, gender
- Research use only

FG-NET database sample



KFRIA Ageing DB

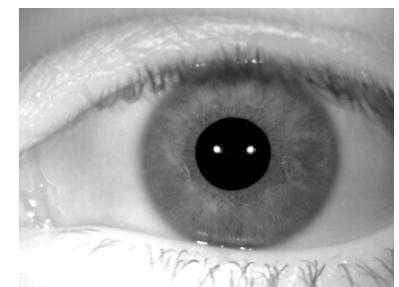
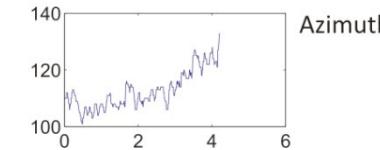
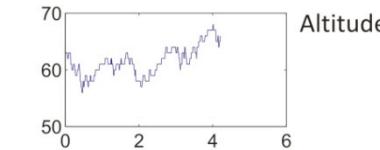
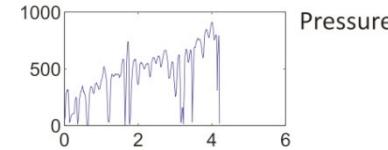
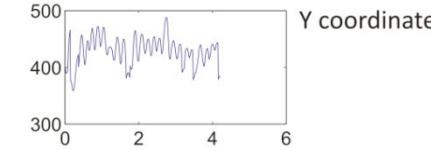
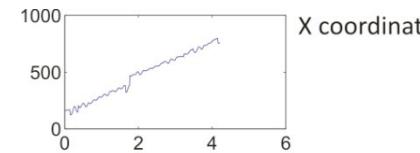
(Korea Fingerprint Recognition Interoperability Alliance)
[Ryu 2007]

- Biometric type: **fingerprints**
- Time interval: 1 year
- Population: 100 subjects, three sensors used
- Demographic data available: age, gender, occupation

Ageing databases

BioBase (www.BiometricLabs.pl)

- Multimodal set: **iris, face, handwritten on-line signatures, fingerprints, hand (2D geometry)**
- Time interval: 7 years
- Equipment and capture protocols kept the same
- Population: 50 subjects
- Extension (planned for mid of 2010) co-sponsored by the Polish Ministry of Science and Higher Education



■ Identification/development of cooperation rules

- Partners and end users, recognition technology suppliers
- Project financing/coordination

■ Identification of the existing databases gathering biometric measurements a few years apart

■ Development of testing methodology and tools

- Analysis of the work already done (especially for face and fingerprints)
- Analysis of the end users requirements

References

[Lantinis 2010]

Lantinis, A. (2010), „A survey of the effects of aging on biometric identity verification,” *International Journal of Biometrics*, Vol. 2, No. 1, pp. 34-52

[Giraldi 2009]

Giraldi, G. A. , Thomaz, C. E., „Statistical Learning Models for Automatic Age Progression”, LNCC - Petrópolis/RJ, LNCC Report 17/2009

[Ramanathan 2006]

Ramanathan N., Chellappa R., „Face verification across age progression,” *IEEE Transactions on Image Processing*, Vol. 15, no. 11, pp. 3349-3361, 2006

[Ricanek 2006]

Karl Ricanek Jr and Tamirat Tesafaye, "MORPH: A Longitudinal Image Database of Normal Adult Age-Progression," *IEEE 7th International Conference on Automatic Face and Gesture Recognition*, Southampton, UK, April 2006, pp 341-345

[Gurbuz 2000]

S. Gurbuz, J.N. Gowdy, and Z. and Tufekci, "Speech spectrogram based model adaptation for speaker identification," in *Southeastcon 2000. Proceedings of the IEEE*, Apr 2000, pp. 110-115

[Ryu 2007]

J. Ryu, J. Jang, H. Kim, „Analysis of Effect of Fingerprint Sample Quality in Template Ageing”, *NIST Biometric Quality Workshop*, November 7-8, 2007